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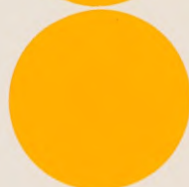
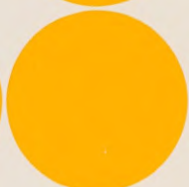
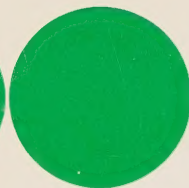
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Hidden Hazards on Playgrounds for Young Children

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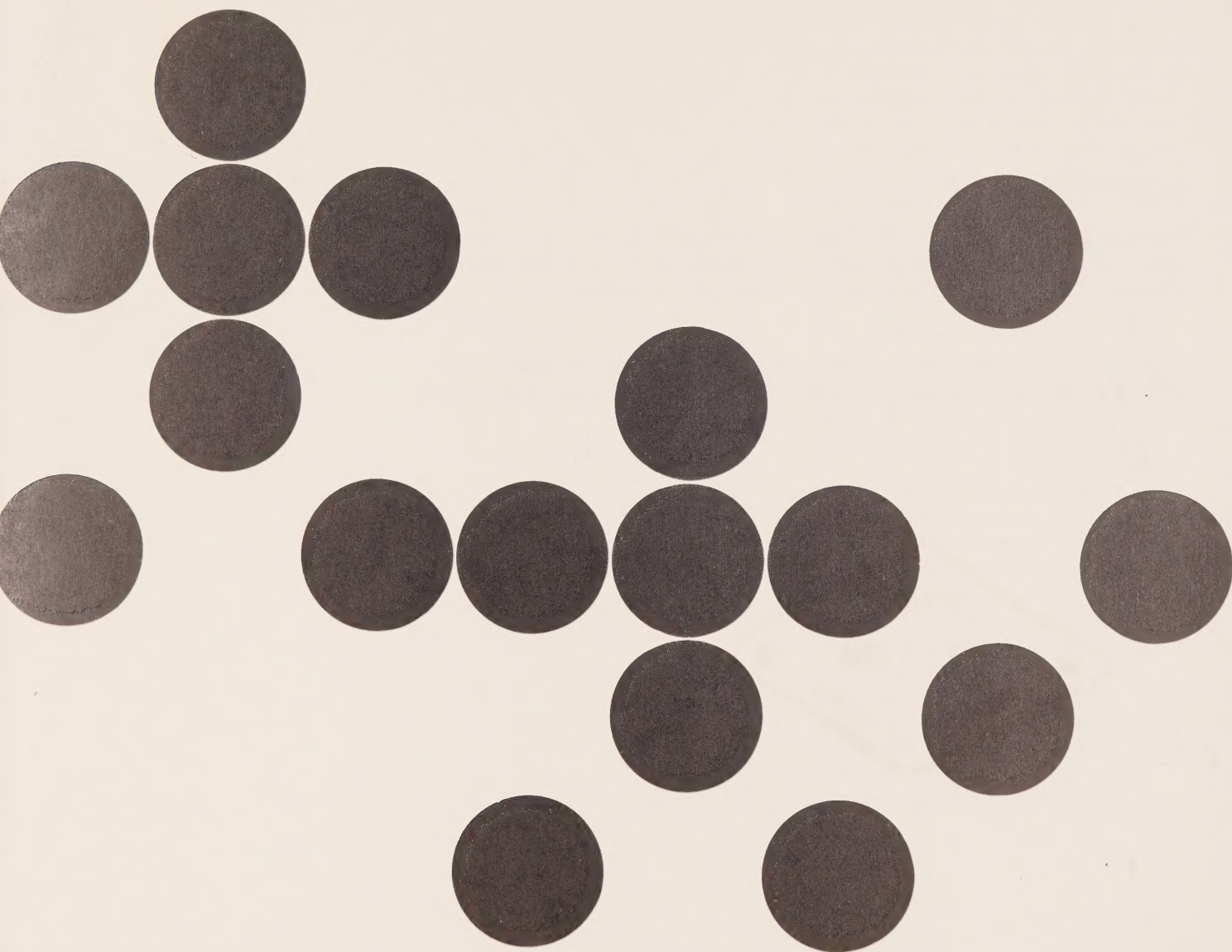
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Hidden Hazards on Playgrounds for Young Children



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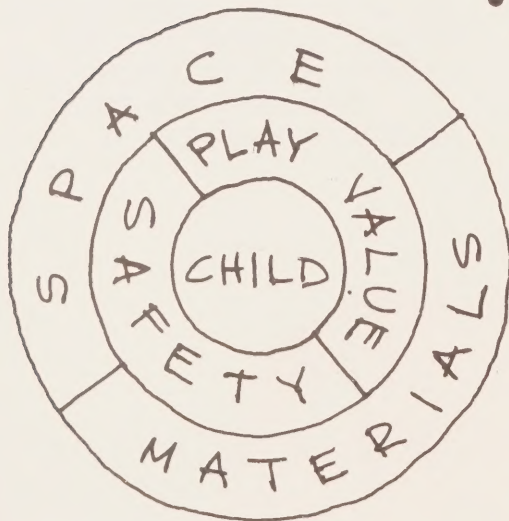
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There are times when going out to play is no longer fun. Likewise there are times when going to the playground stops being a pleasure. Sunday was one of those days. It was a beautiful day, sunny with warm gusts of wind, generally a great day for going out to play with the children. Off we went to the newest playground for young children in the city, the latest example of municipal care for young children and their families. We arrived with our bikes and found, to our surprise, bicycle racks right outside the fenced-in playground. The presence of the bicycle racks and a fenced-in yard were a welcomed change from other public playgrounds, where in fact parents are constantly anxious for the child's safety, and bikes are usually left cluttering the yard. As we walked, half-ran into the yard, the variety of textures available on the playground, such as grass, bushes, sand, trees, wooden structures, a metal swing set and asphalt surfacing for wheeled toys, became more and more noticeable. In fact, we formed a very favourable first impression of a "safe" playground for young children. Hold on! Did I say "safe"? Perhaps I'd better reserve judgment until a more systematic look at the playground is undertaken.

Playground Assessment Framework

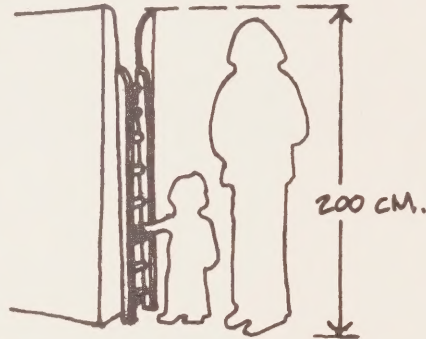
In order to maintain objectivity in determining whether a playground for young children is "safe" as well as stimulating, a framework based on theory and practical research is proposed. The framework assumes that on a municipal, school or housing development playground, adult supervision is only occasionally provided when the parents accompany their children to the site. Therefore the "place" and "materials" of the playground must be designed and constructed so as to minimize hazard, and provide safe and stimulating play opportunities for children. The diagram serves to underline the important interrelationship between the site, materials, play value and safety. Utilizing this framework, elements within each category are itemized to facilitate a more thorough critique and assessment of the playground.



Site Assessment Criteria

The location and the size of the playspace will have a great influence on the use, both in terms of frequency of use and the quality of use. The site should:

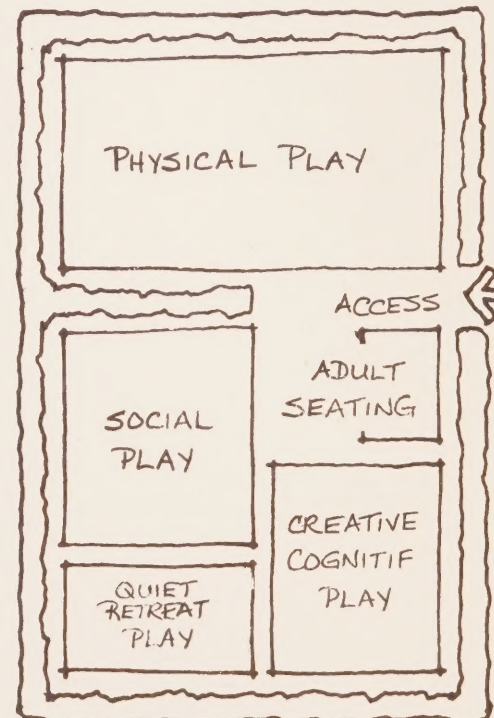
- be large enough to accommodate a variety of play activities;
- provide a place for adults to sit;
- maintain a scale and cozy quality which relates to the size of young children;



- be easily accessible to young children and their accompanying adults;
- be located so as to minimize disturbances to others;

- have landscaping characteristics which provide some protection from prevailing winds;
- have a sunny aspect;
- be accessible for maintenance equipment;
- provide a variety of colour, through the landscape and the play equipment;
- present children with variance in form;
- provide a variety of texture in the surfacing materials;
- provide different contours to create focal points;
- provide a variety of landscape components and topography;
- be enclosed to ensure that young children are protected from the automobile;
- provide for the four basic play categories; physical, social, creative-cognitive, and quiet retreat as elaborated in *Play Spaces for Preschoolers*, CMHC 1978;

LOW ENCLOSURE



Hazardous Issues

- provide soft and hard surface areas to accommodate different activities;
- provide open and closed areas to facilitate a variety of play possibilities;
- encourage children to feel protected and to seek privacy as well as feel secure in public areas;
- be located in an environmentally safe area, not adjacent to a major thoroughfare where exhaust fumes will be strong, nor adjacent to toxic sites or industrial waste facilities.

The above list is only partial and reflects only the general considerations which apply to an assessment of the play value and safety qualities of a play-space site.

The consideration given to the quality, the play value and safety of playground equipment is equally important as the assessment made of the site characteristics. The man-made components are either custom-built or purchased from playground equipment manufacturers. The play value, safety and durability of such equipment is variable, and currently no standards exist in North America for the design, construction or security provided by built play components.

Safety on playgrounds, in child care centres and schoolyards has become an important issue in recent years. Comprehensive statistical data based on thousands of accidents in several countries now exists. According to a study by Dr. Søren Christensen et al. of Arhus General Hospital in Denmark during 1980-81, it is the age group 2-7 years that is most at risk on playgrounds. Other studies on injuries in child care centres in the USA document the frequency and severity of reported accidents on playgrounds. According to Dr. Susan Aronson of Pennsylvania, 422 accident claims were filed with the Forrest T. Jones Co., Inc. in 1981-82.

This company manages the National Association for the Education of Young Children's Child Care Center Student Accident Plan. The data is limited as it only documents reported accidents and does not report on the numerous cases where no accident claim is filed. These studies, along with a study conducted by Drs. Woodward; Feldman et al., 1983 in Canada, begin to identify a growing need for thorough safety evaluations of playground sites and playground equipment. "In Stockholm, in 1955, 4% of the children at day nurseries and 3% of children at school met with accidents. School accidents accounted for 28% of the accidents in the children of school age (7-15 years). In West Germany it has been reported that annually 4% of children at school meet with accidents resulting in insurance claims."¹

In Canada, Helen Haffey at the Toronto Hospital for Sick Children has summarized the data from the department of medical records. In 1981 there were 407 children hurt from falls from playground equipment, 52 children were admitted to the hospital. Falls from slides were very frequent; 141 falls or around 30% of all falls were from playground equipment. One hundred and fifty children fell from climbing bars and falls of five were serious enough to warrant being admitted to the hospital. Eighty-one children were injured by falls from slides and 15 were admitted to the hospital. The hospital also recorded 105 children being bumped on playground equipment; around 2/3 or 56 children were hit by swings. John Walker at the Children's Hospital of Eastern Ontario found similar results during a study of trauma seen in the emergency department during October, November and December 1980. During the three-month period 5% of all visits followed accidents caused on playground equipment. Not surprisingly 20% of all accidents occurred at school, and accidents on monkeybars and climbing equipment represented 55% of all accidents.

The frequency and severity of injuries on playgrounds for young children is alarming, as the majority of the accidents can be attributed to negligence on the part of adults. According to the rating system used by Aronson 1983, climbing equipment was more than twice as hazardous as slides. Despite the above data, the number of true accidents on playgrounds is dif-

Materials Assessment Criteria

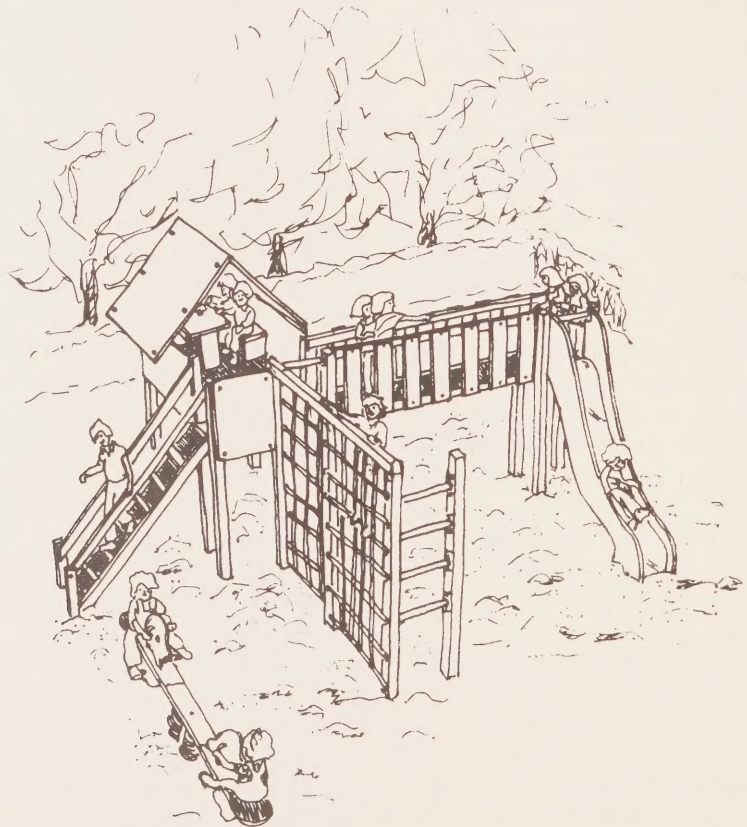
difficult to ascertain as few emergency treatment centres in hospitals record where, how and what accidents happen on playgrounds. The number of unreported accidents which children keep to themselves; falls, cuts, bruises, twisted arms, burnt skin etc., combined with treated but unrecorded accidents attended to by the school nurse or teacher, helps us to recognize that the actual frequency of accidents is much greater than the data suggests.

As equipment on the playground is frequently the cause of injury to children, then it is crucial that playground equipment be made safe. Hazardous design and construction must be corrected and serious commitments must be made to provide only safe materials and playground equipment in new or renovated playgrounds.

The following list of design and construction details are itemized to further enhance the assessment framework used in reviewing playgrounds for younger children (0-9 years of age).

The playground equipment should:

- complement the overall site and the environment in which it is to be placed;
- provide play value which is compatible with the zone in which the equipment is placed;
- be smoothly finished with no protruding elements such as bolts or steel rods that might cause injury to the children;
- be in scale to the size of young children;
- have access to higher levels which are challenging and safe;
- provide swings and seesaws that are constructed in such a way that even very young children can easily play on them;
- have slides that are at heights which correspond to the size and the age of the child;
- be well finished and have smooth corners to eliminate splinters and cuts;
- be placed on a surface which has a relatively satisfactory shock absorbing quality;
- be positioned so as to avoid collision between pieces of equipment;
- provide colour to supplement the natural beauty surrounding the playspace.



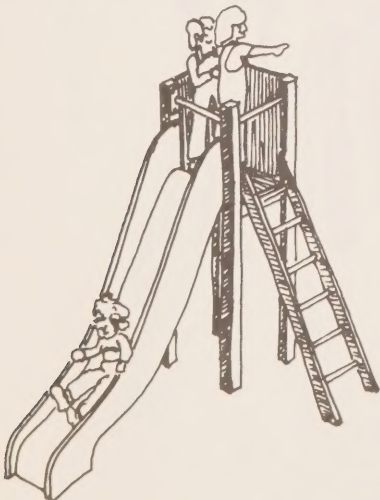
Slides

The general design considerations apply to all equipment located on the site. The following design criteria apply to specific structures or play equipment components:

Slides can be designed safely to enable children to slide from great heights, alone or together with other children. The type of sliding experience desired will have consequences for the design and construction specifications. The following recommendations apply generally to all forms of slides.

Slides should:

- have a debarkation platform which is enclosed so that it is virtually impossible for a child to fall down;
- provide a side-screen which extends outward from the debarkation platform;
- provide side-screening on the slide (about 8-15 cm high) to prevent children from rolling off the slide;
- always have a run-off lip at the base to create a smooth stop without a sudden impact to the feet or back;



- have a support plate to the run-off lip which is wrapped underneath the sheeting, thus eliminating sharp edges or joints from the slide;
- be made of single pieces of stainless steel sheets as much as possible — longer slides should be carefully constructed so that there are no chances of metal cuts to children;
- have no metal bolts or other sharp construction braces visible on the sliding surface or inside the side-screens;
- never be positioned in an open area with a southern exposure;
- have a barrier to encourage sitting on the slide rather than walking or running down;
- have a slope which will provide speed without endangering the child;
- be embedded in a 40-degree embankment which has a peak large enough to accommodate several children at once;
- have a safety zone, on the average, of 3m × 6m (2m out front of the debarkation lip);
- not descend in a direction where children are at play.

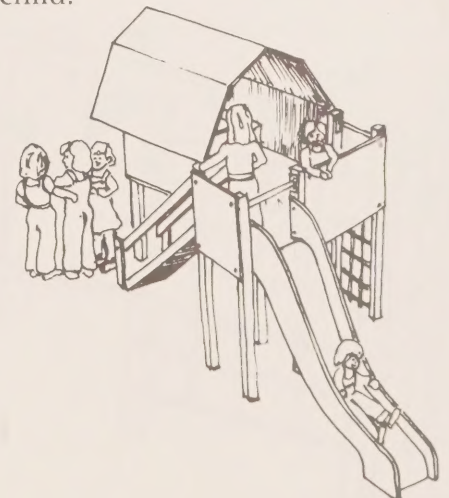
Access to slides or climbing structures should:

- be varied and challenge the child to concentrate on the activity of climbing;
- be safe so that the child will have a good balance and grip as he/she climbs up or down;
- provide arms and legs with coordinated movement to challenge the whole body;
- avoid the use of only simple stairs which do little to challenge the motor integration

and coordination skills of the child;

- bring the child to a resting (transition) space which is safe and relaxing before undertaking the next adventure;
- be free of protruding nuts or bolts;
- have rungs which are about 30cm apart to allow easy grasp;
- have rungs which allow the child's hand to enclose more than 2/3 of the rung's circumference;
- be firm so as to avoid unpredictable jerky movements while climbing;
- place ladders at an angle for heights greater than 1.35m off a soft surface;
- be firm to prevent fingers from becoming pinched in between a rung and a platform (or a rope and a platform).

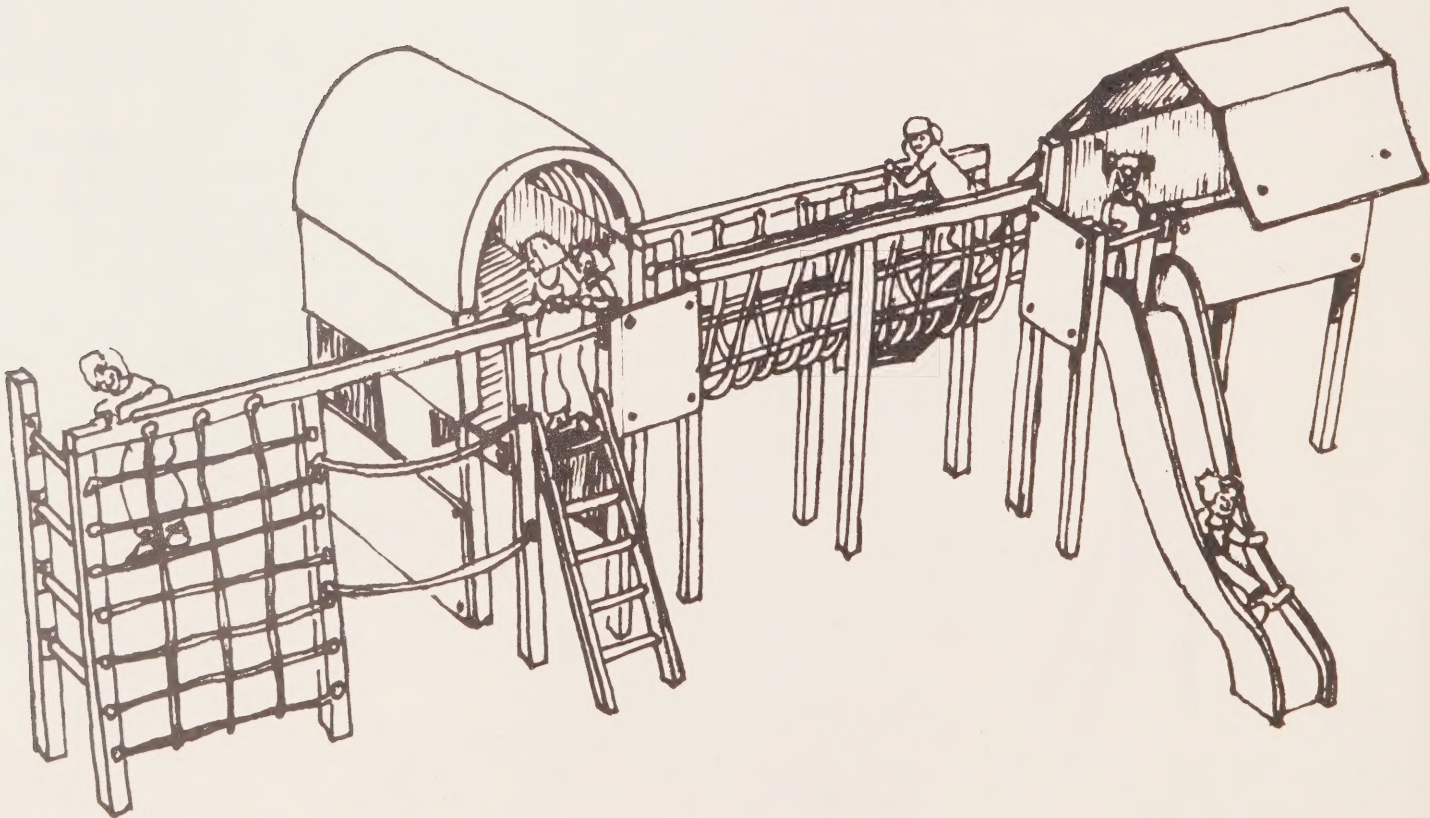
In the event that rope climbing nets (or suspension nets) are used, they must be firmly connected and avoid the use of connections which can cut a child.



Climbing Structures

Climbing structures which are designed to meet children's desire to attain height should always be placed over sand to soften falls in the case of accidents. Careful design and construction will minimize chances of falls, as well as the frequency of such accidental falls; therefore, structures should:

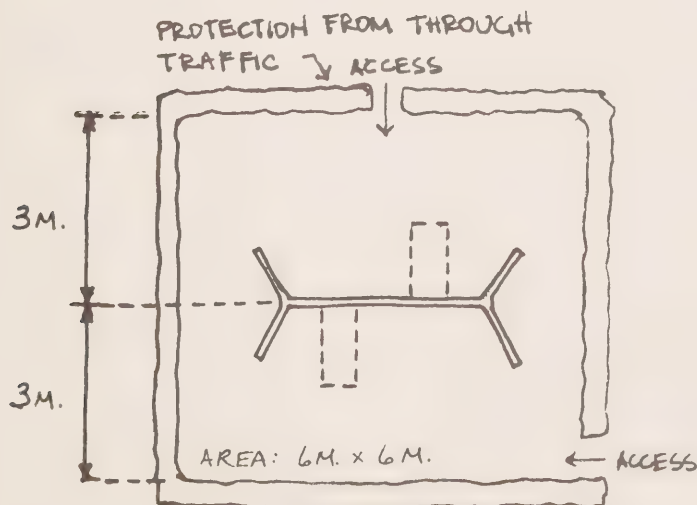
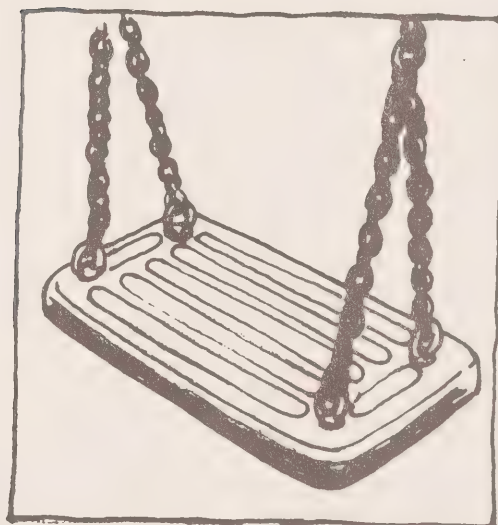
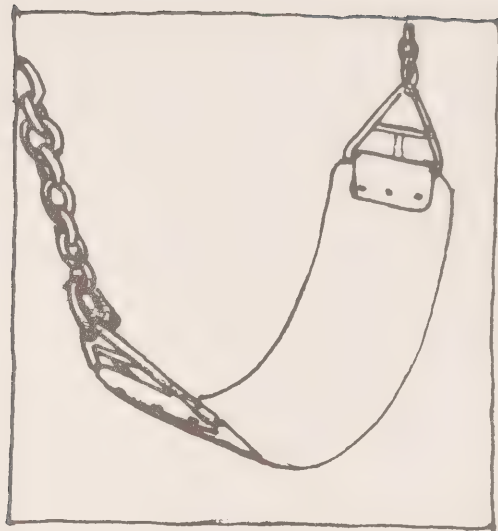
- be enclosed with at least 80cm high protective siding;
- have either a solid siding or vertical boards which will make climbing on the siding impossible;
- never have horizontal bars which allow children to climb higher than the planned height;
- be thoughtfully designed so that incompatible activities are avoided;
- not place a slide and ladder parallel to each other as such placement will encourage children to jump onto the slide from the ladder;
- not place a horizontal ladder above or adjacent to a slide as such equipment will allow children to swing their feet down into the body of a sliding child;
- have safe and scaled ways of getting from one part of the structure to another;
- avoid having open platforms adjacent to a swing;
- be free of protruding metal parts, nuts, bolts and nails;
- have a soft surface, i.e. sand underneath the swings.



Swings

Swings have undergone a tremendous evolution during the last two decades. The wooden swing seats, so popular on backyard trees a decade ago, are now replaced by absorbent rubber tires, plastic or strap seats. Whatever, the hardware used to make swings is not the only consideration which helps to make a swing set safe. The framing and surrounding play components have a direct influence on the quality of the experience children have while swinging. The following criteria applies to the swing set and its surrounding area. Swings should:

- be located in an area where the danger of being hit is minimized;
- have an area of $6\text{m} \times 6\text{m}$ clearance around the swing set and 3m from the fulcrum in either direction;
- be enclosed by a hedge or low fence to prevent small children from running into the path of a moving swing.



Sand

Essentially there are two kinds of sand recommended for use in playgrounds; sand for sand-boxes or sand areas, and impact sand which is used under climbing equipment, swings and similar equipment from which there is a possibility of falling.

Sandbox sand

In a sandbox or similarly designated sand area, children use the sand to make forms, tunnels, roads and whatever else their imagination dictates. Sand selected for this area must hold together when moulded so as not to frustrate the children at play.

The sand should:

- pack well when moist, so as to maintain the shapes made by the children;
- be a balanced mixture of particle sizes, ranging from coarse sand (preferably not more than 1.5 mm) to very fine sand;
- be like seaside sand or a well-washed sand of the above mixture;
- be clean; it should be free of dirt, clay, silt oxides or iron or other contaminants.

A good depth of the sand in the sand area is between 38-45cm.

The following procedure is recommended prior to accepting delivery of sand. Take a white cloth and place a sample of the sand in the cloth to see if the damp sand stains or discolours the cloth. Discolouration or stain on the cloth indicates that the sand has not been sufficiently washed and that clay or dirt is still too prevalent for it to be used as effective sandbox sand.

N.B. Pay particular attention to the presence of any sharp materials such as artificially crushed stone. Such material can cause cuts and minor skin irritations and could be potentially dangerous to the eyes.

Maintenance

Sandbox or sand-play area:

The sand in the sandbox should be raked over regularly to remove all surface debris. Special care should be taken to remove broken glass, plastic and rusty cans, along with fecal matter from animals.

In high-use urban areas sand should be given a treatment with chloride approximately once a week. During summer months this treatment should be increased.

Recipe for cleaning sandbox:

- 220ml fluid chloride of lime to 18L of water for each 10 cubic metres of sand
- 1 – 9L bucket
- 1 – 9L watering can.

Directions for cleaning a sand box:

Acquire two (18L) containers (bucket and watering can). Fill the bucket and the watering can with water, add 110mL of fluid chloride to each container and stir well with a stick. Use the watering can to distribute the solution over the sandbox. The more equal distribution provided by the watering can assures better maintenance. When empty, the watering can should be refilled from the bucket and the remainder of the sandbox thoroughly covered by the disinfectant mixture. Subsequent to application of the chloride solution, hose down the area to allow the solution to penetrate into the sand. Be sure to allow it to penetrate.

The sand should then be turned over one shovel (19cm) deep before the children use it again. Once this has been completed the children can resume their play in a clean bacteria free sandbox.

Caution

Be sure to mix the disinfecting materials thoroughly with the sand. Avoid excessive hosing of the sandbox as it will cause waterlogging and penetration of decaying vegetable matter, i.e. leaves.

Be sure to periodically turn the sand over to its full depth. Remember to change the sand when it shows signs of becoming excessively dirty and unmanageable. Your attention to maintenance can increase the life of the sandbox and the health of your children.

Surfacing

Impact sand

Impact sand is used under climbing equipment, swings and similar equipment from which there is a possibility of falling. The primary purpose of this sand is to cushion and absorb a fall. It must therefore be sand which does not pack together to become a hard surface. The quality of the sand is essentially the opposite of sandbox sand. Wind-blown sand such as found in sand dunes is an excellent example of impact sand. It consists of rounded particles of uniform size which move easily against each other, and thus give when hit by an object or a child.

Dune sand does have one very apparent disadvantage, in that when dry, it will blow around with the wind. This problem can be overcome when the area where it is used is enclosed by a hedge or similar windscreen device.

In reality, dune sand is also very difficult to obtain; it is therefore recommended that larger particle sand of 1.5 to 0.25 mm be used, providing the particles are not too abrasive so as to cause damage to the child's skin.

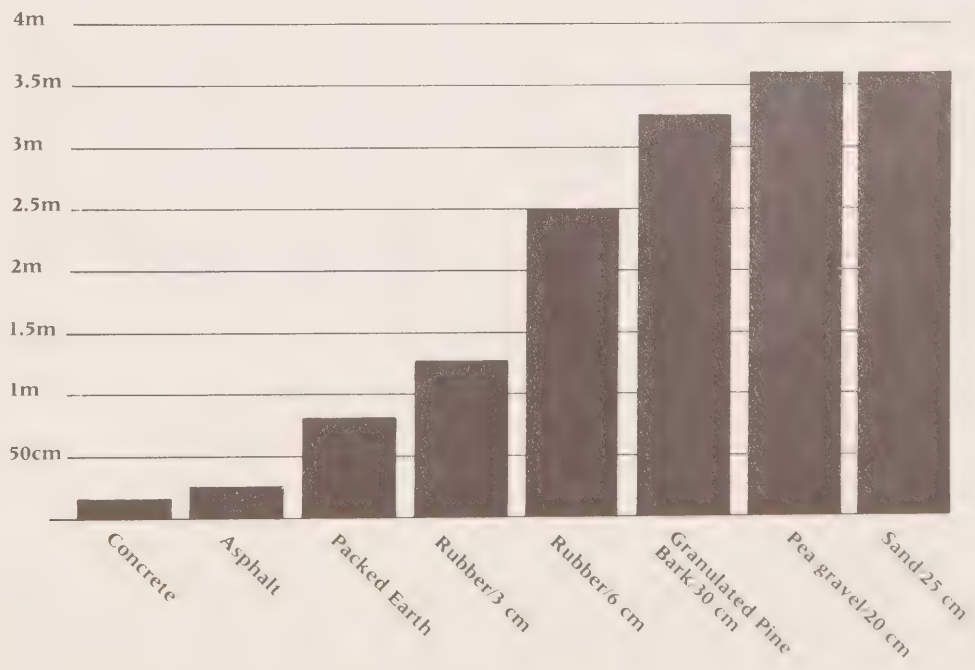
Another alternative to consider for impact purposes is small gravel or finely crushed rock (again check for abrasion and compacting hazards). Whichever sand or particle material you decide to use as impact surface, be sure to provide a depth of approximately 30 cm to provide sufficient absorption.

Maintenance of impact sand

This consists essentially of commonsense. Keep the impact sand free of dirt, broken glass, weeds and debris. Turn the sand regularly with a pitch fork, especially in heavily used areas where sand tends to become compressed and as hard as asphalt.

In recent years a variety of materials have been used as surfacing under playground equipment. Sand, gravel, granulated pine bark and rubber matting are materials which, if provided in a sufficiently thick layer, have a relatively satisfactory shock absorbing ability. They must be used selectively to achieve a safe play surface around the playground equipment.

The table below shows the height from which a young child can fall head first onto different impact surfaces before the critical limit for causing concussion, expressed as 50 G, (G = gravity). The Franklin Institute Research Laboratories in the USA have undertaken comparative tests concerning the relationship between surface materials under playground equipment, height of fall and G-effect.



Overview

This criteria is set forth to provide a preliminary guide for assessing playground equipment and its location on a site. With this list, it is possible to systematically review playspaces in child care centres, schoolyards and municipal parks so as to determine whether the equipment is well designed and constructed. This form of critical assessment should help playground designers and manufacturers to become more critical of their products and thus contribute to the elimination of hazards on playgrounds. The situation in 1983, when the most common causes of accidents were falls from playground equipment, bad surfacing, incorrect scaling and methods of construction, as well as lack of maintenance, will not remain stagnant. Hopefully, the more attention adults give to selecting the outdoor play furniture for children, the better children will be able to play. Ideally, the more critically adults look at the potentially hazardous situations in playgrounds, the longer and safer children will play. The investment in good outdoor furniture, ie, playground equipment for young children which meet the criteria for good design and construction, will serve to diminish the cost of emergency health care as well as short-term and permanent disabilities.

It is possible that upon reading this article people will admit that playground planning is more than child's play. If so, then perhaps the concern for objectivity which was identified earlier can be appreciated. This said, the assessment of the playground visited on Sunday will now utilize the framework and criteria set forth. Familiarity with this specific playground is not necessary, as the readers need only observe similar play situations in their own cities.

The four wooden play structures built on the site are located in such a way as to provide minimal conflict between the kinds of play activities likely to occur on the site. For example, the largest playground structure is located in a corner, well out of the way of the seating area and sand-play area. However, a smaller climbing structure with a slide for the younger children is located in the sand pit only 2.5m from the sand-play table. The two other structures are quite unobtrusive and appear to provide some additional play opportunities as part of the materials supplementing the overall integrity of the site.

Having thus introduced the play structures and their relationship to the overall site characteristics, the following critique will now deal only with the playground apparatus. Judgments will be made about safety, scale and the design quality as seen on the newly-installed equipment.

The Large Playground Structure

Access:

Essentially two ways of reaching the first level of the platform structure are provided. The primary access route is provided by stairs wide enough to accommodate two children at a time. Usually, stairs provide children with an experience which is predictable. The distance between each step, the depth of the step and the railing serve to provide them with an environment which is both predictable and safe. On this play structure the steps conform to these norms; however the railings are not entirely in scale with the hand grip of small children, nor is the railing placed at a correspondingly scaled height for the child. Thus it is possible that the smaller child could fall down onto the sand between the stairs and the railing.

Children are also offered access to the first platform by a chain ladder attached vertically to the upper horizontal enclosure bar. The chain ladder has rungs which measure 24.5cm in circumference, and are therefore

too massive for the grip of a preschool age child. The galvanized steel chains are also an additional hazard for small children who may pinch their fingers when holding onto the chain.

The access to the upper level is more difficult, so that one would expect that it is only the more physically adept child who will climb up to the second level and be 185cm above ground level. One would therefore also assume that the physically competent young child is safe on the top platform. However, the child who reaches the top has to be not only physically competent but also mature enough to know not to climb the horizontal boards enclosing the platform. If the child were to climb onto the boards he could fall from more than 2 metres.

Descent:

Once children have reached the top platform they have two possible options for getting down. They can jump down to the first level and potentially collide with other children, or slide down the two-person slide which faces due south and is so hot that children in shorts are uninspired to use it more than once.

Slides

A design detail which is a common hazard on many slides is the point of debarkation from the platform. There are no protective grips or railings for young children getting ready to slide. The absence of such design features makes the slide a potentially dangerous item on the playground as children can easily fall down from the platform. This overlooked design detail also applies to the tot slide which is attached to the smaller platform structure on the playground. On the tot slide a galvanized flat-head nail was protruding from a board right before the beginning of the slide. These design and construction details are examples of how poor attention to detail in design and construction will make playground equipment dangerously unpredictable for young children. The details in such items are already dealt with in some European countries, where standards for playground equipment require slides to have a protective design to keep small children from losing their balance and falling forward or sideways.

The slide should provide children with a thrilling experience which they will want to repeat without fear. The lip extension on the slide is therefore as important to the slide as is the take-off. The lip detail on the slide in this park is much improved over the generation of slides still dominating municipal and school playgrounds throughout North America; however a small child may still fall backwards and hit his/her back on the lip as it exists on the two slides.

Transition Structure

A safer design would have the lip of the slide descend in such a way that the child would fall back upon a smooth brace rather than a blunt point. These details are noticeably absent from slides manufactured or made for young children in North America.

The rocking bridge structure is positioned in a space on the site so as to act as a transition structure between the taller climbing structure and the tot structure. Unfortunately, the children have to step up 44-46cm to reach the sway bridge and in so doing they have to avoid scraping their legs on eight exposed nuts and bolts on either end of the bridge. These fixtures protrude 2-3cm out from the beam and demonstrate how poor detail can become an accident-provoking detail for young children.

Social Playhouse

The house on stilts is 34cm off the ground level and so is far from being comfortable for a two-year-old. The horizontal bench seat which is 49cm off the platform level is “quasi comfortable” for a child 10 years of age or older. Younger children cannot comfortably sit on the bench with their feet firmly on the ground, and therefore find the structure uncomfortable and unplayable. The horizontal bar at the end of the house is 84cm above the floor level and thus raises serious questions about its height. The average 2 to 4-year-old child is likely to knock his/her head on this beam rather than perceive it as a barrier which provides them with a little privacy. The result of the assessment of the play structures provided on this renovated pre-school playground is not favourable when all the details are reviewed.

Unfortunately, this is the case for the majority of structures found on many playgrounds throughout North America. Before further summarizing the assessment, the following comments concerning specific design and construction hazards will be provided.

Swings

Exposed nuts and bolts were seen at lower leg level and at eye-head level underneath the large climbing structure. Protruding metal bolts were also located precariously close to the debarkation platform on the slide.

Flat-head nails were seen working their way out of the boards on the tot structure as well as on the social playhouse, where the roof appeared to be coming apart due to warping wood.

Aside from these obvious design and construction flaws, the limited play value provided by the equipment is a further indication of how little design detail is given to the development of the playground equipment. The so-called social playhouse is merely an A-frame roof on stilts, with no privacy or enclosed space provided for the children to sit and talk. The fact that children stayed on the equipment for only a few seconds during three different observation periods, serves to indicate the limited attraction provided.

The swing frame is the only piece of equipment remaining from the previous playground. The metal frame is located in an area which initially appears to be out of the way; however children running down the stairs of the large climbing structure risk running directly into the path of swinging children. This area needs to be enclosed by a hedge as stipulated in the criteria section.

A playground's use is ultimately dependent upon the quality of the site and materials. The design and construction detail given to the space and to the equipment will affect the frequency and kind of use made of the playground. In further reviewing this play space, adults were asked how they felt about the park. Generally, all found the park very attractive, and a good improvement to the neighbourhood. Not one of them, and all were parents, had noticed the flaws identified in this assessment. While none of the items identified are serious themselves, the overall impact of this playground assessment is alarming and raises serious concerns about obscured societal abuse and neglect towards children.

This statement is further indicative of the need for society to recognize the impact of adult oversight in the design of playgrounds and towards the developmental needs of children at play. The more dramatic effect of this oversight is the health and safety hazards presented to children on poorly-designed and constructed playgrounds such as exemplified by this case. The desired cumulative effect of this assessment is for parents and teachers of young children to become much more aware of the hazards, for manufacturers to become more sensitive to the design criteria, and for parks and recreation developers to be more careful in their choice of equipment and installation. Hopefully, this report will help to diminish the number of hazardous playgrounds and to make the playtime of young children safer and more stimulating in the future.

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